

**CLAIMS:**

1. In a bandwidth management device for use in a data communication network, a method of controlling an input packet for managing a rate of any traffic stream corresponding to said input packets, said bandwidth management device having a memory, which comprises a plurality of cells as time-division queues, each queue corresponding to a time slot of a constant interval in time domain, said method comprising the steps of:

(a) retrieving quality of service (QoS) information of said traffic stream from said input packet;

(b) determining whether the rate of said input packet exceeds a legal rate predetermined for said traffic stream based on said QoS information;

(c) if the rate of said input packet exceeds the predetermined legal rate, dispatching said input packet into a time-division queue; and

(d) transmitting said input packet queued in said time-division queue out of said bandwidth management device when the corresponding time of said time-division queue is equal to the system time of said bandwidth management device.

2. The method as set forth in Claim 1, wherein step (c) further comprises the steps of:

(c1) if the rate of said input packet exceeds the predetermined legal rate, determining the time slot which said input packet belongs to, based on the QoS information of said input packet, wherein said determined time slot corresponds to said time-division queue of step (d).

3. The method as set forth in Claim 2, wherein the plurality of

time slots are sequentially arranged in a time ring having a period (Time Ring Size, TRS), said time ring consists of a plurality of time slot clusters of a constant interval, and each time slot cluster comprises one or more time slots, and wherein step (c) further comprises the steps of:

5           (c2) determining a time slot cluster to which said determined time slot belongs;

10           (c3) if said determined time slot cluster contains the time slot which said input packet belongs to, appending said input packet into a time division queue of said determined time slot in said determined time slot cluster; and

15           (c4) if said determined time slot cluster does not contain the time slot which said input packet belongs to, adding a new time slot to said determined time slot cluster and appending said input packet into the time division queue of said determined time slot in said determined time slot cluster.

4. The method as set forth in Claim 1, said method further comprising: after step (b), if the rate of said input packet does not exceed the predetermined legal rate, directly transmitting said input packet out of said bandwidth management device.

20           5. A bandwidth management device for use in a data communication network, said bandwidth management device comprising:

25           a flow classification module for retrieving quality of service (QoS) information from said input packet; and determining whether the rate of said input packet does not exceed the legal rate predetermined for said traffic stream based on said QoS information;

          a memory comprising a plurality of cells as time division queues, each queue corresponding to a time slot of constant interval in the time

domain;

a rate evaluator for dispatching said input packet into a time division queue if the rate of said input packet exceeds the predetermined legal rate, and transmitting said input packet queued in said time division queue out of  
5 said bandwidth management device when the corresponding time of said time division queue is equal to the system time of said bandwidth management device.

6. The bandwidth management device as set forth in Claim 5, wherein said rate evaluator further determines the time slot which said  
10 input packet belongs to, based on the QoS information of said input packet, if the rate of said input packet exceeds the predetermined legal rate, and wherein said determined time slot corresponds to said time division queue of step (d).

7. The bandwidth management device as set forth in Claim 5, wherein the plurality of time slots are sequentially arranged in a time ring  
15 having a period, said time ring consists of a plurality of time slot clusters of a constant interval and each time slot cluster comprises one or more time slots, and wherein said rate evaluator determines the time slot cluster which said determined time slot belongs to; appends said input packet into the  
20 time division queue of said determined time slot in said determined time slot cluster if said determined time slot cluster contains the time slot which said data packet belongs to; adds a new time slot to said determined time slot cluster and appends said input packet into the time division queue of  
25 said determined time slot in said determined time slot cluster if said determined time slot cluster does not contain the time slot which said input packet belongs to.

8. The bandwidth management device as set forth in Claim 5, said rate evaluator directly transmits said input packet out of said bandwidth management device if the rate of said input packet does not

exceed the predetermined legal rate.

9. In a bandwidth management device for use in a data communication network, a method for controlling the rates of any bi-directional traffic stream between any two terminals over said data communication network, said bandwidth management device having a memory, which comprises a plurality of cells as time division queues, each queue corresponding to a time slot of a constant interval in a time domain, said method comprising the steps of:

(a) detecting synchronous segments during said two terminals initially set up a connection therebetween;

(b) retrieving maximum segment size (MSS) option headers transmitted between said two terminals in said synchronous segments, wherein said MSS option header transmitting from one terminal designates a payload of said input packet coming from the other terminal;

(c) retrieving quality of service (QoS) information from said input packets;

(d) modifying said MSS option header transmitting from one terminal based on the rate contained in the QoS information of said one terminal so as to reduce the largest payload of said input packet, if the payload determined by said MSS header will cause said bandwidth management device cannot control the rates of said bi-directional traffic stream; and recalculating a checksum of a TCP header of said input packet with said MSS option header, if said MSS option header has been modified;

(e) determining whether the rate of said input packet, no matter whose payload is reduced or not, exceeds a legal rate predetermined for said input packet based on said QoS information;

(f) if the rate of said input packet exceeds the predetermined legal

rate, dispatching said input packet into a time division queue; and

(g) transmitting said input packet queued in said time division queue out of said bandwidth management device when the corresponding time of said time division queue is equal to the system time of said bandwidth management device.

10. The method as set forth in Claim 9, wherein step (e) further comprises the steps of:

(e1) if the rate of said input packet exceeds the predetermined legal rate, determining the time slot which said input packet belongs to, based on the QoS information of said input packet, wherein said determined time slot corresponds to said time division queue of step (f).

11. The method as set forth in Claim 10, wherein the plurality of time slots are sequentially arranged in a time ring having a period (TRS), said time ring consists of a plurality of time slot clusters of a constant interval and each time slot cluster comprises one or more time slots, and wherein step (e1) further comprises the steps of:

(e2) determining the time slot cluster to which said determined time slot belongs;

(e3) if said determined time slot cluster contains the time slot which said input packet belongs to, appending said input packet into the time division queue of said determined time slot in said determined time slot cluster; and

(e4) if said determined time slot cluster does not contain the time slot which said input packet belongs to, adding a new time slot to said determined time slot cluster and appending said input packet into the time division queue of said determined time slot in said determined time slot cluster.

12. The method as set forth in Claim 9, further comprising: after step (e), if the rate of said input packet does not exceed the predetermined legal rate, directly transmitting said input packet out of said bandwidth management device.

5

T05011" 884800T